

Raman Spectroscopic Detection of Biogeological Markers in Terrestrial Mars Analogs : Instrumentation .

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Raman spectroscopy is under consideration for adoption as life detection instrumentation on planetary landers ; the ease of sampling which requires little or no physical or chemical pretreatment , the information that can be obtained from inorganic and organic chemical species in the same spectral data and the successful miniaturization of prototype spectrometers for trialling experiments have made the Raman technique a realistic possibility for space missions. The identification of biological extremophiles in a range of terrestrial Mars analogs provides a superior testing scenario for Raman spectroscopic instrumentation because these situations represent a “limits of life” endeavour on our own planet before life becomes extinct ; in these situations it is paramount to be able to assess the presence of extant or relict organisms in the geological record through the biochemicals and biogeological modifications that have occurred in the extremophilic strategy for survival.

In this paper we shall explore several possibilities for the Raman spectroscopic detection of life signatures through key spectral biomarkers in geological substrata and describe some pitfalls and instrumental difficulties that need to be addressed for the adoption of a remote Raman spectrometer designed for the acquisition of biological and geological spectral data as part of a robotic planetary lander . Examples will be taken from our work with extremophiles from cold desert habitats in Arctic and Antarctic locations .